

Precise Control of Dissolved O₂ and N₂ in Semiconductor Applications Using Liqui-Cel® Membrane Contactors

There is a trend in the semiconductor industry for precise control of oxygen and nitrogen concentrations in ultrapure water. Specifically there is a goal in the polishing loop of a semiconductor plant to control dissolved oxygen to low levels of 1 ppb or 5 ppb. At the same time it is important to control the dissolved nitrogen between 8-12 ppm.

When it comes to total gas control, Liqui-Cel® Membrane Contactors offer the best solution; you can dial in your gas concentrations when using Membrane Contactors. Vacuum towers cannot be used to control multiple gasses to specific concentrations.

Membrane Contactors connected in two stages or two in series can achieve any combination of O₂/N₂ gas control. The primary advantage of using two contactors is that you can eliminate complicated process controls that would normally be required to handle the concentration swings of the incoming O₂ and N₂.

The first contactor establishes a base level or an O₂ and N₂ in the water. The second contactor is then used to re-dissolve gases into the water. You can achieve a saturation level by controlling the vacuum and the O₂/N₂ gas ratio. To achieve 8-12 ppm dissolved N₂ we use N₂ sweep in combination with vacuum. Gas Concentrations can be 'dialed in' by controlling the sweep gas absolute pressure, as shown in the equilibrium chart (illustration 2).

The control of both O₂ and N₂ can be achieved as follows.

Regular N₂-combo mode is used in the first contactor with fairly deep vacuum to reduce both the O₂ and N₂ concentrations in the water. A second contactor is used in N₂-combo mode with a low-grade vacuum to increase the N₂ concentration by blending in a very small controlled amount of air into the N₂ sweep. See illustration 1.

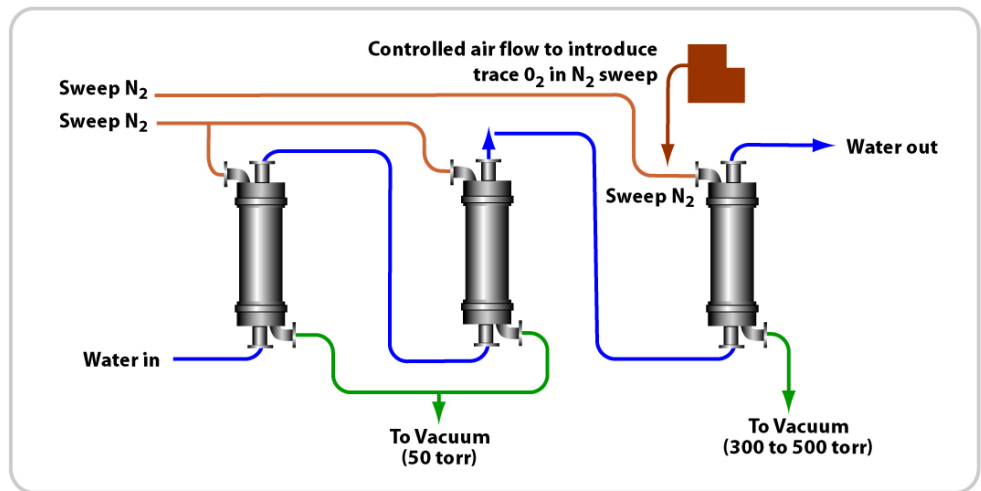


Illustration 1

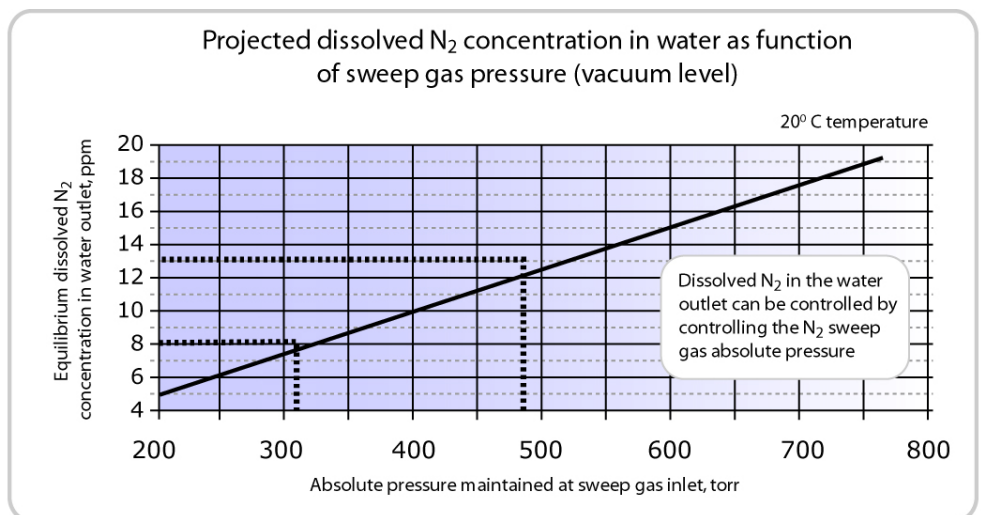


Illustration 2

The amount of air needed for blending can be calculated based on the equilibrium dissolved O₂ concentration depicted in the chart (illustration 3) to the right.

Maintaining the vacuum level in the module will control the dissolved N₂ concentration, whereas adjusting the flow rate of the air that is bled into the N₂ Sweep will control the dissolved O₂ concentration.

The system set-up described above is a less expensive option for controlling the gas concentrations in the degassing system. The control system is also less complicated and easy to adjust.

The benefit to the semiconductor plant is that they have complete control over the concentrations of gasses dissolved into the ultrapure water with a small and compact Membrane Contactor system.

We will work with you to provide a better understanding of the system economics for your situation.

For more information on using Liqui-Cel Membrane Contactors in your application, please visit us on-line at www.liqui-cel.com or call us at the numbers listed below.

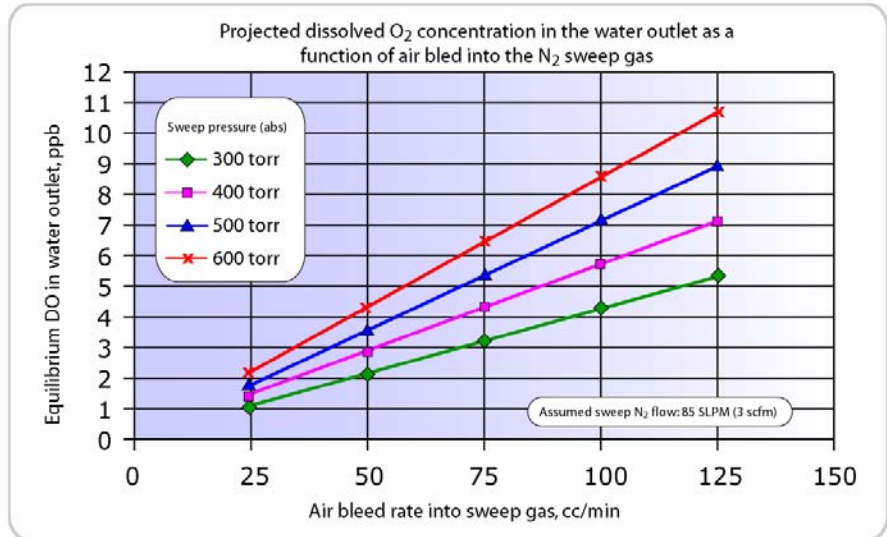


Illustration 3

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